

with normal: Hilo, 100 per cent; Hamakua, 115 per cent; Kohala, 155 per cent; Waimea (Hawaii), 75 per cent; Kona, 170 per cent; Kau, 70 per cent; Puna, 100 per cent; Maui, 150 per cent; Oahu, 95 per cent; Kauai, 135 per cent.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 80.4° ; mean minimum, 69.5° ; Waimea, Hawaii, 2,730 elevation, 82.3° and 65.7° ; Kohala, 521 elevation, 79.3° and 67.5° ; Waiakoa, Kula, Maui, 2,700 elevation, 78.5° and 60.0° ; Ewa Mill, 50 elevation, 84.8° and 67.5° ; United States Experiment Station, Jared W. Smith, 350 elevation, 83.4° and 70.2° ; W. R. Castle, 60 elevation, highest, 84° ; lowest, 66° ; mean, 75.2° .

Ewa Mill mean dew-point, 64.6° ; mean relative humidity, 68.7 per cent; Kohala, Dr. B. D. Bond, 66° and 78 per cent.

Slight but decided earthquake felt at Honolulu, 4:31 a. m., 16th, day of lunar eclipse; same reported from Kohala, Waimea, 2 shocks, and Hilo, Pepeekeo. On the 20th, Kohala, 5:30 a. m., 26th, Waimea, 3:05 and 11:05 p. m. Heavy swell and surf 15th, 17th, 27th, and 28th. Heavy rains, 3d, 15th, and 27th.

Heaviest 24-hour rains reported: Rhodes Gardens, 4.23 inches; Waiakea, Hilo, 3.31 inches; Luakaha, 4.00 inches, 27th; Puuohua, Hilo, 3.43 inches, 14th.

OBSERVATIONS AT HONOLULU.

The station is at $21^{\circ} 18' N.$, $157^{\circ} 50' W.$ It is the Hawaiian Weather Bureau station Punahoa. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.) Hawaiian standard time is $10^{\circ} 30'$ slow of Greenwich time. Honolulu local mean time is $10^{\circ} 31'$ slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, -0.06 , has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, October, 1902.

Date.	Pressure at sea level.	Dry bulb.	Wet bulb.	During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.								Total rainfall at 9 a. m., local time.		
				Temperature.		Means.		Wind.		Sea-level pressures.				
				Temperature.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Pervailing direction.	Force.	Average cloudiness.	Maximum.	Minimum.	
1	*	†	†	68.5	84	70	67.0	73	ne.-n.	2-1	7-1	29.95	29.86	0.00
2	29.89	68	67.3	84	72	66.3	72	n.	1	4-2	29.98	29.87	0.00	
3	29.95	75	69	84	68	68.0	79	nne.	1	3	30.02	29.93	0.13	
4	29.97	75	69	83	72	66.0	67	ne.	3	3	30.03	29.94	0.02	
5	29.95	69	67.7	80	73	66.0	71	ne.	3-1	7	30.04	29.95	0.11	
6	29.92	68	67	83	68	68.5	82	nne.	2	3-9	30.00	29.91	0.00	
7	29.89	70	68	82	67	68.3	87	ne.-sw.	1-0	8	29.94	29.84	0.03	
8	29.91	72	71.5	82	67	69.0	82	s.-sw.	1-0	3	29.94	29.36	0.08	
9	29.94	70	69	82	71	71.0	85	sw.	1-0	5	29.97	29.88	0.05	
10	30.02	70	68.7	82	70	70.0	85	sw.	1-0	3	30.03	29.93	0.02	
11	29.98	75	70	83	69	69.0	83	n.-ne.	1	6-0	30.07	29.97	0.00	
12	29.94	75	70.5	84	68	67.7	73	nne.	2	1	30.04	29.94	0.21	
13	29.94	76	69.5	83	71	67.0	70	ne.	3-5	2-7	29.99	29.90	0.04	
14	29.95	75	69	81	72	66.7	70	nne.	5-2	7-2	29.99	29.89	0.15	
15	30.05	74	67	80	72	67.3	74	ne.	3-4	7	30.06	29.96	1.05	
16	30.05	74	66	79	70	62.7	67	nne.	5-0	2	30.10	30.08	0.00	
17	30.02	69	64	80	73	62.0	63	ne.	3	7-2	30.09	29.99	0.01	
18	29.98	73	66.5	81	68	62.3	66	nne.	3	3	30.04	29.94	0.00	
19	29.99	75	67	81	73	62.0	64	ne.	3	2	30.04	29.94	0.00	
20	30.03	74	68	81	74	63.3	64	ne.	3	3	30.06	29.96	0.01	
21	29.97	73	67.5	80	72	64.0	66	ne.	3	4	30.06	29.97	0.00	
22	29.96	71	68.5	82	72	65.5	72	ne.	3-1	3	30.02	29.91	0.00	
23	29.96	68	67	83	68	67.7	78	se-ne.	1-0	6-3	30.00	29.91	0.01	
24	29.96	67	66	82	68	67.7	82	sw-n.	1-0	7-1	30.00	29.91	0.01	
25	29.94	69	68.5	83	67	66.3	76	se-ne.	0-2	2	30.00	29.88	0.02	
26	29.93	74	69	84	67	68.0	78	se-ne.	1-2	2	29.98	29.91	0.00	
27	29.99	75	71	82	72	66.5	70	ne.	3	1	30.02	29.92	0.15	
28	29.97	74	70	78	72	68.7	84	nne.	4	5	30.08	29.98	0.45	
29	29.94	76	71	81	72	67.7	77	ne.	4	4	30.01	29.91	0.03	
30	29.94	75	68.5	81	73	67.7	74	ne.	3-4	5	29.97	29.87	0.00	
31	29.95	66	65	82	73	64.5	66	nue.	3	1	30.00	29.92	0.00	
Sums.													2.59	
Means.	29.963	72.5	68.2	81.8	70.3	66.6	74.5		2-1	3.3	30.017	29.922	
Departure.	+ .002				+ 0.4	+ 3.5			-1.0				-0.17	

Mean temperature for October, 1902, $(6+2+9)+3=75.8$; normal is 76.4 . Mean pressure for October, 1902, $(9+3)+2=29.969$; normal is 29.967 .

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of $(6+9+2+9)+4$. § Beaufort scale.

Rainfall data for October, 1902.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.
HAWAII.					
HILO, e. and ne.	Feet.	Inches.	MAUI.—Continued.	Feet.	Inches.
Waiakea	50	12.37	Paia	180	2.15
Hilo (town)	100	12.12	Haleakala Ranch	2,000	4.00
Kaumana	1,250	11.52	Wailuku, ne.	200	0.94
Pepeekeo	200	12.13	OAHIU.		
Hakalau	300	12.94	Punahou (W. B.), sw.	47	2.59
Honohina	1,050	18.98	Kulaokahua (Castle), sw.	50	2.16
Punohua	500	11.78	Makiki Reservoir	120	2.96
Laupahoehoe	400	10.14	U. S. Naval Station, sw.	6	1.56
Ookala	HAMAKUA, NE.		Kapiolani Park, sw.	10	0.73
Kukaihau	250	6.95	Manoa (Woodlawn Dairy), c.	235	11.75
Pasailo	750	6.26	Manoa (Rhodes Gardens), c.	300	15.46
Paauhau (Mill)	300	4.62	School street (Bishop), sw.	50	2.95
Honokoa (Muir)	425	4.75	Insane Asylum, sw.	30	2.15
Honokoa (Meincke)	1,100	5.93	Kalihii-Uka, sw.	450	9.18
Kukuihae	700	5.49	Niuuan (W. W. Hall), sw.	50	8.04
KOHALA, N.			Niuuan (Wyllie street), sw.	250	5.12
Niuli	200	5.83	Niuuan (Elec. Station), sw.	405	5.85
Kohala (Mission)	521	5.93	Niuuan (Luakaha), c.	850	13.12
Kohala (Sugar Co.)	235	5.98	Waimanalo, ne.	25	2.69
Puakea Ranch	600	3.29	Maunawili, ne.	300	5.42
Hawi	600	1.54	Anaehi	100	4.81
Puuhue Ranch	2,720	2.37	Waihi	350	5.75
Waimea	KONA, W.		Kabukio, n.	25	3.22
Kailua	950		Wahiala	900	0.79
Holualoa	1,350	9.03	Ewa Plantation, s.	60	1.64
Keaakeku	1,580	11.20	Waipahu	200	0.65
Napoopo	25	5.90	Moanalua	15	1.83
KAU, SE.			U. S. Magnetic Station	50	1.35
Kahuku Ranch	1,680	2.87	Tantalus Heights	1,360	11.99
Honuapo	15	1.38	U. S. Experiment Station	350	3.81
Naalehu	650	2.17	KAUAI.		
Hilea	310	0.60	Lihue (Grove Farm), e.	200	5.06
Pahala	850	1.72	Lihue (Molokoa), e.	300	4.92
Mosula	1,700		Lihue (Kukaua), e.	1,000	12.53
PUNA, e.			Kealia, e.	15	3.96
Volcano House	4,000	3.18	Kilauea, ne.	325	7.19
Olaa, Mountain View (Russel)	1,690	11.36	Hanalei, n.	10	9.32
Kapoho	110	8.63	Waioli	10	7.40
MAUI.			Waiawa	32	
Lahaina	WAIKALOAKOSA.		Eele	200	
Waipao Ranch	700	0.62	Waihawa	2,100	5.37
Kaupo (Mokulau), s.	285		Delayed September reports.		
Kipahulu, s.	300		Kaumana		
Nahiku, ne.	80		Waipaoe Ranch (Maui), s.		1.98
Nahiku	800		Haleakala Ranch (Maui), s.		3.03
Haiku, n.	700	6.32	Waihawa (Oahu)		2.63
Kula (Walakos), n.	2,700	1.68	Waiawa (Kauai)		0.00
Kula (Erehwon), n.	4,500	2.31	Waihawa Mt., s (Kauai)		10.20

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on earthquakes.—October 9, slight shock at $4^h 6^m$ p. m., duration 2 seconds. October 13, medium shock at $4^h 29^m$ a. m., duration 9 seconds. October 14, slight shock at $5^h 49^m$ a. m., duration 7 seconds. October 15, slight shock at $2^h 10^m$ a. m., duration 5 seconds.

CYCLES OF PRECIPITATION.

By L. H. MURDOCH, Section Director, Salt Lake City, Utah, dated October 20, 1902.

In Utah a cycle of unusually heavy precipitation began in 1866 and continued until 1886. During that period the old settlers confidently asserted that the climate had changed to wetter and even men of scientific training tried to explain the increased precipitation as due to human agencies. It was stated that the humidity had been greatly increased by breaking up the land, irrigation, increased vegetation, etc. Since 1886 the precipitation has been deficient and nothing is now heard on the subject of human agencies increasing the humidity. Most men who spent their youth here between 1866 and 1886 will now tell you that the climate has changed to drier.

It is, therefore, evident that the person who forms the opinion that climate is changing, based upon his own personal experience, is very likely to be mistaken. And yet no one who has stood near Salt Lake City and observed on the mountain sides the shore lines of the ancient Lake Bonneville can doubt for a